Amendments to the Drawings:

The attached replacement sheets of drawings include changes to Fig. 1, 2, 3A, 3B, 4, 5A and 5B and replaces the original sheets including Fig. 1, 2, 3A, 3B, 4, 5A and 5B.

No new matter has been added.

REMARKS

This application has been amended. Claims 1-9, 11-17, 19-25 and 27-30 are pending with claims 1, 14, 22 and 25 being independent. Claims 10, 18 and 26 has been canceled without prejudice. Claims 1, 3, 6-9, 11-17, 19, 20 and 22-25 have been amended. Claims 27-30 are new. No new matter has been added.

Reconsideration and allowance of the above-identified patent application are hereby requested.

Claim 1 has been amended to recite "determining nodal voltages corresponding to nodes of a circuit network and branch currents corresponding to branches of the circuit network, wherein the determining comprises: representing the circuit network using a matrix of nodes having fine nodes and coarse nodes that correspond to the nodes of the circuit network, wherein the matrix of nodes represents a system matrix of a matrix equation for determining the nodal voltages and the branch currents." Support for the amendment can be found in the Specification, for example, in paragraphs 22-23. Claim 1 has been further amended to recite "dynamically changing designations of active and inactive regions of the circuit network according to circuit activities at different times; computing a residual value of an error after the applying of the iterative smoothing operations at the finest level; comparing the residual value to a pre-determined threshold; and responsive to a result of the comparing, using the matrix equation to determine the nodal voltages and the branch currents." Support for the amendment can be found in the Specification, for example, in paragraphs 42-43. Furthermore, claim 1 has been amended to recite "identifying operational characteristics of the circuit network based on the determined node voltages and branch currents." Support for the amendment can be found in the Specification, for example, in paragraphs 4, 19 and 21. In addition, claim 1 has been amended to recite that "the determining nodal voltages and branch currents and the identifying operational characteristics are performed by one or more computer processors." Support for the amendment can be found in the Specification, for example, in paragraph 68.

Claim 14 has been amended to recite "determining nodal voltages corresponding to nodes of a circuit network and branch currents corresponding to branches of the circuit network", and

"the nodes of the levels of grids correspond to the nodes of the circuit network." Support for the amendments can be found in the Specification, for example, in paragraphs 22-23. Claim 14 has been further amended to recite "assigning a portion of a given level of grids as active local grids and a remainder of the given level of grids as inactive local grids, wherein the active local grids correspond to active circuit regions in the circuit network" and "performing an iterative smoothing operation at each level of grids to obtain computation results of each level of grids comprising states of nodes in each level of grids, wherein the iterative smoothing operation is performed in a given active local grid more frequently than in a given inactive grid." Support for the amendments can be found in the Specification, for example, in paragraphs 21 and 52-54. Furthermore, claim 14 has been amended to recite "identifying operational characteristics of the circuit network based on the determined nodal voltages and branch currents." Support for the amendment can be found in the Specification, for example, in paragraphs 4, 19 and 21. In addition, claim 14 has been amended to recite that "the determining nodal voltages and branch currents and the identifying operational characteristics are performed by one or more computer processors." Support for the amendment can be found in the Specification, for example, in paragraph 68.

Claim 22 has been amended to recite "determining nodal voltages corresponding to nodes of a circuit network and branch currents corresponding to branches of the circuit network, wherein the determining comprises: applying an algebraic multigrid method to a matrix representative of the circuit network to construct a plurality of matrices with different degrees of coarsening grids, wherein the coarsening grids correspond to the nodes of the circuit network, and wherein the matrix representative of the circuit network represents a system matrix of a matrix equation for determining the nodal voltages and the branch currents." Support for the amendment can be found in the Specification, for example, in paragraphs 22-23. Claim 22 has been further amended to recite "responsive to performing the iterative smoothing operation at a given grid having a finest degree of coarsening until a residual error of a solution of the matrix equation is less than a predetermined threshold, using the solution of the matrix equation to determine the nodal voltages and the branch currents." Support for the amendment can be found

in the Specification, for example, in paragraphs 42-43. Furthermore, claim 22 has been amended to recite "identifying operational characteristics of the circuit network based on the determined nodal voltages and branch currents." Support for the amendment can be found in the Specification, for example, in paragraphs 4, 19 and 21. In addition, claim 22 has been amended to recite that "the determining nodal voltages and branch currents and the identifying operational characteristics are performed by one or more computer processors." Support for the amendment can be found in the Specification, for example, in paragraph 68.

Claim 25 has been amended to recite "determine nodal voltages corresponding to nodes of a circuit network and branch currents corresponding to branches of the circuit network, wherein the determination comprises: apply an algebraic multigrid method to a matrix representative of the circuit network to construct a plurality of matrices with different degrees of coarsening grids, wherein the coarsening grids correspond to the nodes of the circuit network, and wherein the matrix representative of the circuit network represents a system matrix of a matrix equation for determining the nodal voltages and the branch currents." Support for the amendment can be found in the Specification, for example, in paragraphs 22-23. Claim 25 has been further amended to recite "perform an iterative smoothing operation in a given active region more frequently than in a given inactive region to solve for a corresponding matrix equation of each grid and to map a computation result of each grid to a next finer or coarser grid until a residual error of a solution corresponding to a grid having a finest degree of coarsening is less than a pre-determined threshold; and use the solution of the matrix equation to determine the nodal voltages and the branch currents." Support for the amendment can be found in the Specification, for example, in paragraphs 42-43. Furthermore, claim 25 has been amended to recite "identify operational characteristics of the circuit network based on the determined nodal voltages and branch currents." Support for the amendment can be found in the Specification, for example, in paragraphs 4, 19 and 21.

Dependent claims 3, 6-9, 11-13 have been amended to address antecedent issues created by the amendment of claim 1. Dependent claims 15-17, 19 and 20 have been amended to address

antecedent issues created by the amendment of claim 14. Dependent claims 23 and 24 have been amended to address antecedent issues created by the amendment of claim 22.

Support for new claims 27-30 can be found, for example, in paragraphs 4, 19 and 21. No new matter has been added.

Summary of Examiner's Interview

An Examiner's Interview was conducted on December 8, 2009. The interview was initiated by Applicants and was between Examiner Nha T. Nguyen and the Assignee's representative Dan Vacar.

During the interview, the present claim amendments as presented in this filing was discussed. In addition, a discussion was also made on the cited references Kozhaya ("Multigrid-Like Technique for Power Analysis", by Joseph N. Kozhaya, Sani R. Nassif, and Farid N. Najm, pages 480 – 487 @2001 IEEE), and Brandt ("Multi-level adaptive solutions to Boundary-Value problems", by Achi Brandt, Mathematics of Computation, Vol. 13, Number 138, pages 333 – 390, April 1977).

It was agreed that the present amendments to the independent claims would overcome the pending rejections under 35 U.S.C. § 101 and under 35 U.S.C. § 112(2). Further agreement was reached that the present amendments to independent claims 1 and 14 would overcome the pending rejections under 35 U.S.C. § 102(b) over Kozhaya, and that the present amendments to independent claims 22 and 25 would overcome the pending rejections under 35 U.S.C. § 103(a) over Kozhaya in view of Brandt.

Specification

The Specification has been amended to comply with the Office's requirement.

Rejection under 35 U.S.C. § 101

Claims 1-9, 11-17, 19-24 stand rejected under 35 U.S.C. § 101 for reasons outlined in the current Office Action, in section 4, pages 2-4. Specifically, the Office states that:

> In order to comply with the 35 USC § 101 statutory requirement, a limitation, i.e., "by using a computer" must be inserted in one of the claimed steps of claims 1, 14, and 22. This would overcome the 35 USC § 101 non-statutory rejection. This would overcome the 35 USC § 101 non-statutory rejection as long as the disclosure support "a computer"

(*See* current Office Action, in section 4, page 4.) Without agreeing to this rejection and only to comply with the Office's suggestion, method claims 1, 14 and 22 have been amended to recite that the claimed operations "are performed by one or more computer processors." This amendment is based on the disclosure of paragraph 68 in the Specification. The foregoing limitation is inherently equivalent with the Office's suggested limitation "by using a computer". In view of the above reasons and additionally based on the agreement reached during the interview, the presented limitation overcomes the 35 U.S.C. § 101 rejection of claims 1, 14 and 22.

Accordingly, withdrawal of the rejection under 35 U.S.C. § 101 of claims 1, 14, and 22 and their respective dependent claims is respectfully requested.

<u>Rejection under 35 U.S.C. § 112(2)</u>

Claims 1-9, 11-17, 19-25 stand rejected under 35 U.S.C. § 112, second paragraph, for reasons outlined in the current Office Action, in section 4, pages 4-5.

Independent claims 1, 14, 22 and 25 have been amended to obviate the rejections. Therefore, withdrawal of the rejection of claim 1, 14, 22 and 25 and their respective dependent claims is respectfully requested.

<u>Rejection under 35 U.S.C. § 102(b)</u>

Claims 1-9, 12-14, 16 ,17 and 19-21 stand rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Kozhaya et al. ("Multigrid-Like Technique for Power Analysis", by Joseph N. Kozhaya, Sani R. Nassif, and Farid N. Najm, pages 480 – 487 @2001 IEEE). The claims have been amended to obviate the rejections.

To be anticipatory under section 102, a single prior art reference must disclose each and every element of the claim at issue. "The identical invention must be shown in as complete detail as is contained in the ... claim." (*See* MPEP § 2131, citing Richardson v. Suzuki Motor Co., 9 USPQ2d 1913, 1920 (Fed. Cir. 1989); emphasis added.) Kozhaya teaches a multigrid-like technique for power grid analysis, but fails to meet the applicable legal standard necessary to support a conclusion of anticipation.

Independent claim 1 has been amended to recite "determining nodal voltages corresponding to nodes of a circuit network and branch currents corresponding to branches of the circuit network, wherein the determining comprises: representing the circuit network using a matrix of nodes having fine nodes and coarse nodes that correspond to the nodes of the circuit network, wherein the matrix of nodes represents a system matrix of a matrix equation for determining the nodal voltages and the branch currents; applying an adaptive coarse grid construction procedure to assign grid nodes in the matrix as either coarse grid nodes or fine grid nodes according to (1) circuit activities and (2) a matrix structure of the matrix to construct a plurality of levels of grids with different numbers of nodes to respectively represent the circuit network; dynamically changing designations of active and inactive regions of the circuit network according to circuit activities at different times; applying iterative smoothing operations at selected local fine grids corresponding to active regions at a finest level obtained in the adaptive coarse grid construction procedure; computing a residual value of an error after the applying of the iterative smoothing operations at the finest level; comparing the residual value to a pre-determined threshold; and responsive to a result of the comparing, using the matrix equation to determine the nodal voltages and the branch currents; and identifying operational characteristics of the circuit network based on the determined node voltages and branch currents." (Emphasis added.)

As described in the Specification, for example, in paragraphs 49-50 and 58, adaptive coarsening based on circuit activities makes it possible to assign more computation resources to active subnetworks of the power network than to the rest of the circuit. "In some power grid networks, […] some nodes of the power network may have more rapid nodal voltage changes

than other nodes. These nodes with rapid changes are more active than the rest nodes of the circuit network. Because of such differences in node activities, the nodes in the circuit network are not computationally equal in the sense that the rapid changes in 'active' nodes should be monitored and analyzed more accurately to adequately model their behavior than the relatively slow changes in 'inactive' nodes. These different computational treatments can be used to accurately characterize the circuit network, to achieve fast convergence in the computation, and to reduce unnecessary computation. In recognition of above, the network analysis methods described here may be implemented in a way to be 'adaptive' in applying the multigrid coarsening so that active regions have finer grid structures than inactive regions." (*See* Specification, paragraphs 48-49.)

In rejecting the underlined portion of claim 1, the Office cites to pages 480, Section 2 of Kozhaya, noting "fine and coarse" [grid nodes], and to pages 482-485, Section 3 of Kozhaya, noting "multi-grid analysis". (*See* Office Action dated 08/12/09, section 7, page 6.) But this fails to address the claimed subject matter.

Kozhaya teaches that "coarse grid correction involves mapping the problem to a coarser grid, solving the mapped problem, and mapping the solution back to the fine grid." (*See* Kozhaya, Section 2, page 481.) Kozhaya further reviews two variations of the multigrid method, namely the standard multigrid (SMG) and the algebraic multigrid (AMG), which are then combined (in Section 3) in Kozhaya's proposed multigrid-like analysis technique. The general approach of Kozhaya's technique "consists of repeatedly coarsening the grid until the problem is small enough to solve exactly using a direct approach, and then mapping the solution back to the original fine grid." (*See Id*, 3 Proposed Multigrid-like Analysis, page 482, and FIGs. 1-4 on pages 483-485.) Nothing here, or elsewhere in Kozhaya, describes the claimed features "an adaptive coarse grid construction procedure to assign grid nodes in the matrix <u>according to circuit activities</u>" and "dynamically changing <u>designations of active and inactive regions</u> of the circuit network <u>according to circuit activities</u> at different times" as recited in claim 1. In fact contrary to claim 1, Kozhaya's analysis explicitly ignores voltage changes at circuit nodes by relying on the assumption that "well-designed power grids are characterized by smooth voltage

variation. Thus [Kozhaya's method ignores] the relaxation (time-dependent) step of AMG without jeopardizing the accuracy of the solution." (*See Id*., page 485.)

Moreover, the Office has provided no explanation as to how Kozhaya's proposed multigrid-like analysis implemented according to the geometrical structure of the grids can be considered equivalent to the claimed features "adaptive coarse grid construction procedure to assign grid nodes in the matrix according to (1) circuit activities and (2) a matrix structure of the matrix" and "dynamically changing designations of active and inactive regions of the circuit network according to circuit activities at different times". In fact, Kozhaya fails to teach or suggest the "applying an adaptive coarse grid construction procedure to assign grid nodes in the matrix as either coarse grid nodes or fine grid nodes according to (1) circuit activities and (2) a matrix structure of the matrix to construct a plurality of levels of grids with different numbers of nodes to respectively represent the circuit network" and "dynamically changing designations of active and inactive regions of the circuit network according to circuit activities at different times" features of claim 1. Thus, Kozhaya does not show the identical invention in as complete detail as is contained in the claim.

In view of the above argument and the agreement reached during the interview, the rejection of claim 1 under 35 U.S.C. § 102(b) over Kozhaya must be withdrawn. Claims 2-9, 12 and 13 depend from claim 1 and are allowable for the same reasons as discussed regarding claim 1.

Further, although directed to different subject matter, independent claim 14 includes features similar to claim 1. For example, claim 14 recites, in part, "the interactive smoothing operation is performed in an active local grid more frequently than in an inactive grid." (Emphasis added.) Accordingly, claim 14 is also in condition for allowance for similar reasons as discussed regarding claim 1. Claims 15-17 and 19-21 depend from claim 14 and are allowable for the same reasons as discussed regarding claim 14.

Rejection under 35 U.S.C. § 103(a)

Claims 11, 15, 22–25 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Kozhaya in view of Brandt ("Multi-level adaptive solutions to Boundary-Value problems", by Achi Brandt, Mathematics of Computation, Vol. 13, Number 138, pages 333 – 390, April 1977). The Office's contentions are respectfully traversed.

Independent claim 22 recites, in part, "representing regions in the circuit network exhibiting active circuit activities with active grids and regions in the circuit network exhibiting less active circuit activities with inactive grids; performing an iterative smoothing operation in an active grid more frequently than in an inactive grid to reduce an amount of computation." (Emphasis added.) The proposed combination of Kozhaya and Brandt fails to disclose at least the underlined features of claim 22.

As described with respect to claim 1, the multigrid-like analysis in Kozhaya does not include "representing regions in the circuit network exhibiting active circuit activities with active grids and regions in the circuit network exhibiting less active circuit activities with inactive grids." In contrast to claim 22, Kozhaya teaches constructing grids based solely on the grid geometry, and ignoring relaxation (time-dependence) of the power grid circuits. (*See* Kozhaya, FIGs. 1-4, and pages 282-285.) Therefore, Kozhaya cannot possibly teach the "performing an iterative smoothing operation in an active grid more frequently than in an inactive grid to reduce an amount of computation" feature of claim 22. (Emphasis added.)

Even as the Office concedes to the above deficiency of Kozhaya,

> Kozhaya does not explicitly discloses the features: smoothing operation in an active grid more frequently than in an inactive grid to reduce an amount of computation.

the Office contends that

> However, Brandt discloses the above features (See Brandt, Page 334, i.e. increasing fineness, See Page 357, i.e. adaptivity of grid, See Page 363-370, i.e. adaptive discretization).

(*See* Office action, section 8 pages 15-16.) The proposed addition of Brandt does not alleviate the deficiencies of Kozhaya. Brandt teaches multi-level adaptive solutions to boundary-value problems, however Brandt fails to address the claimed subject matter. Specifically, Brandt

teaches "manipulating accurate solutions on coarser grids, with only 'infrequent' visits to pieces of finer levels." (*See* Brandt, page 334.) However in contrast to the claimed feature "representing regions in the circuit network exhibiting active circuit activities with active grids and regions in the circuit network exhibiting less active circuit activities with inactive grids", Brandt's techniques address structural (geometrical) aspects of the grids. For example, Brand teaches using irregularly shaped grids or rectangular grids. (*See Id*., page 357.) Finally, the adaptive discretization techniques taught by Brandt are also directed to grid optimization based on mesh size and geometry. (*See Id*., FIG. 4 and pages 363-370.)

None of Brandt's techniques can be deemed to include the "representing <u>regions in the circuit network exhibiting active circuit activities</u> with active grids and <u>regions in the circuit network exhibiting less active circuit activities</u> with inactive grids" feature of claim 22. (Emphasis added.) Therefore, Brandt necessarily fails to teach or suggest "<u>performing an iterative smoothing operation in an active grid more frequently than in an inactive grid</u> to reduce an amount of computation" as recited in claim 22. (Emphasis added.)

Accordingly, the combination of Kozhaya and Brandt fails to teach or suggest "representing <u>regions</u> in the circuit network <u>exhibiting active circuit activities with active grids</u> and <u>regions</u> in the circuit network <u>exhibiting less active circuit activities with inactive grids</u>; <u>performing an iterative smoothing operation in an active grid more frequently than in an inactive grid</u> to reduce an amount of computation", as recited in claim 22. (Emphasis added.)

In view of the reasons discussed above and based on the agreement reached during the interview, claim 22 is patentable over the proposed combination of Kozhaya and Brandt. Claims 23-24 depend from claim 22 and are allowable for the same reasons as discussed regarding claim 22.

In addition, although directed to different subject matter, independent claim 25 includes features similar to claim 22. For example, claim 25 recites, in part, "divide the circuit network into <u>active regions</u> and <u>inactive regions</u> according to circuit activities; <u>perform an iterative smoothing operation in an active region more frequently than in an inactive region</u>." (Emphasis

added.) Accordingly, claim 25 is also in condition for allowance for similar reasons as discussed regarding claim 22.

Additionally, claim 11 depends from claim 1 and is patentable over Kozhaya at least for the reasons discussed with respect to claim 1. The proposed addition of Brandt does not cure the deficiencies of Kozhaya. For example, for reasons described with respect to claim 22, Brandt fails to teach or suggest the ""applying an adaptive coarse grid construction procedure to assign grid nodes in the matrix as either coarse grid nodes or fine grid nodes according to (1) circuit activities and (2) a matrix structure of the matrix to construct a plurality of levels of grids with different numbers of nodes to respectively represent the circuit network" and "dynamically changing designations of active and inactive regions of the circuit network according to circuit activities at different times" features of claim 1. (Emphasis added.) For at least these reasons claim 11 is patentable over the proposed combination of Kozhaya and Brandt.

Further, claim 15 depends from claim 14 and is patentable over Kozhaya at least for the reasons discussed with respect to claim 14. The proposed addition of Brandt does not cure the deficiencies of Kozhaya. For example, for reasons described with respect to claim 22, Brandt fails to teach or suggest the "the interactive smoothing operation is performed in an active local grid more frequently than in an inactive grid" feature of claim 14. For at least these reasons claim 15 is patentable over the proposed combination of Kozhaya and Brandt.

Finally, newly presented claims 27-30 are patentable over the prior art of record at least for the same reasons discussed above regarding their respective base claims.

CONCLUSION

The foregoing comments made with respect to the positions taken by the Examiner are not to be construed as acquiescence with other positions of the Examiner that have not been explicitly contested. Accordingly, the above arguments for patentability of a claim should not be construed as implying that there are not other valid reasons for patentability of that claim or other claims.

In view of the amendments and remarks herein, claims 1-9, 11-17, 19-25 and 27-30 are in condition for allowance. A formal notice of allowance is respectfully requested.

Please apply any necessary charges or credits to deposit account 06-1050.

Respectfully submitted,

Date: December 14, 2009____________

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